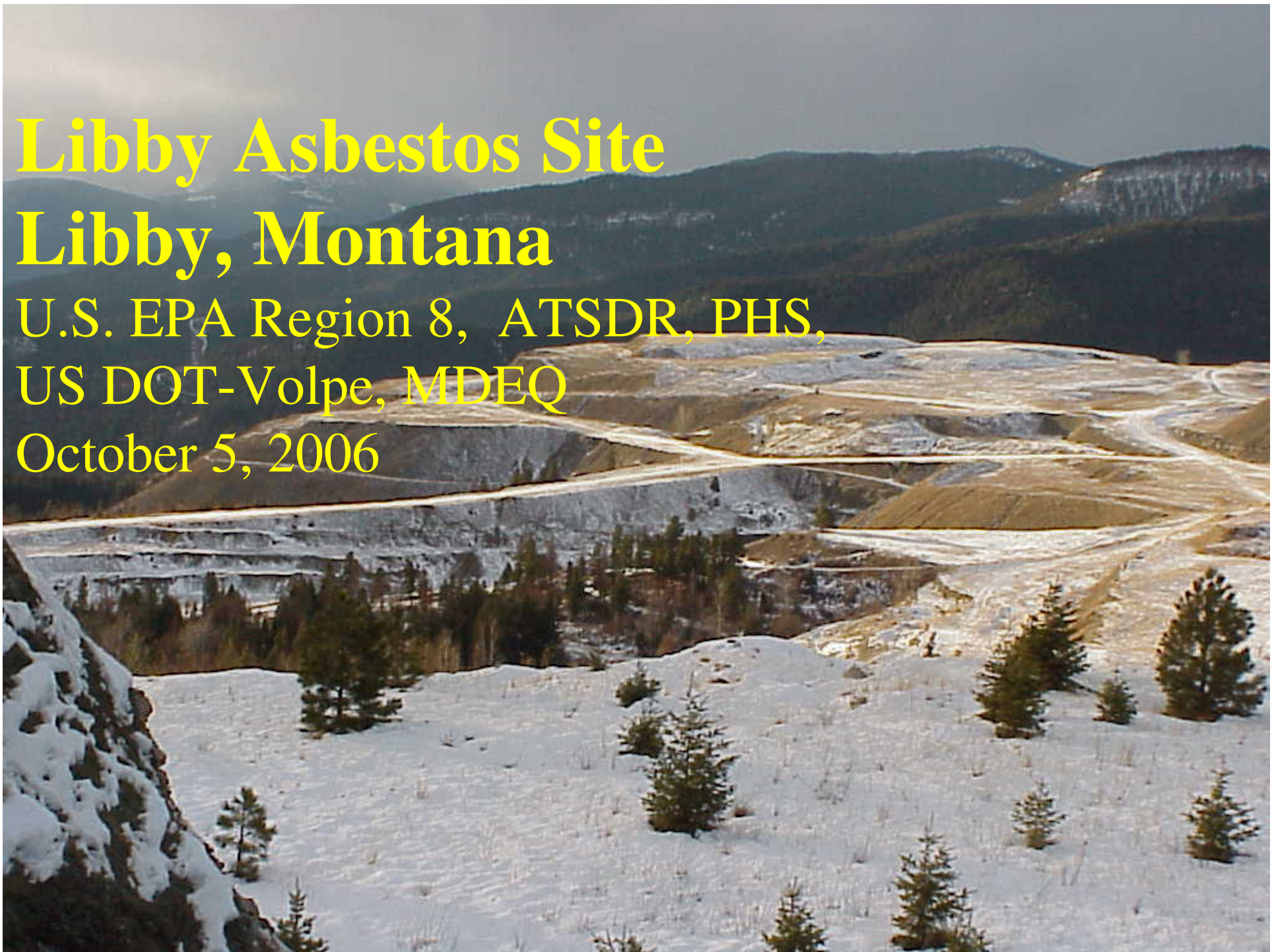


Libby Asbestos Site

Libby, Montana

U.S. EPA Region 8, ATSDR, PHS,
US DOT-Volpe, MDEQ
October 5, 2006



1074091

Presentation Overview

- Libby Asbestos Summary
- Contamination in Libby
- Health Effects
- Current Situation
- Current Issues
- Proposed Approach
- Enforcement Update

Two General Types of Asbestos

- **Serpentine Asbestos** (chrysotile)
 - Most commonly used.
 - Snake-like structure.
- **Amphibole Asbestos** (hundreds of fiber types)
 - Few commercial uses
 - Straight, spear-like structure.
 - Most literature considers more toxic.

Asbestos Mineral Types

Classic Regulated Forms (6)

Commercial Designations

■ Serpentine

- Chrysotile

Comprises >90% of the asbestos used in products

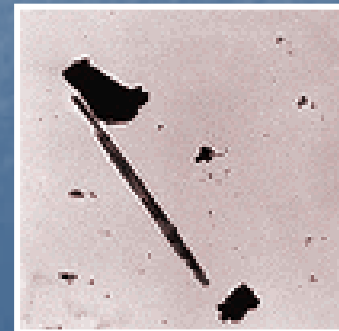
Curly



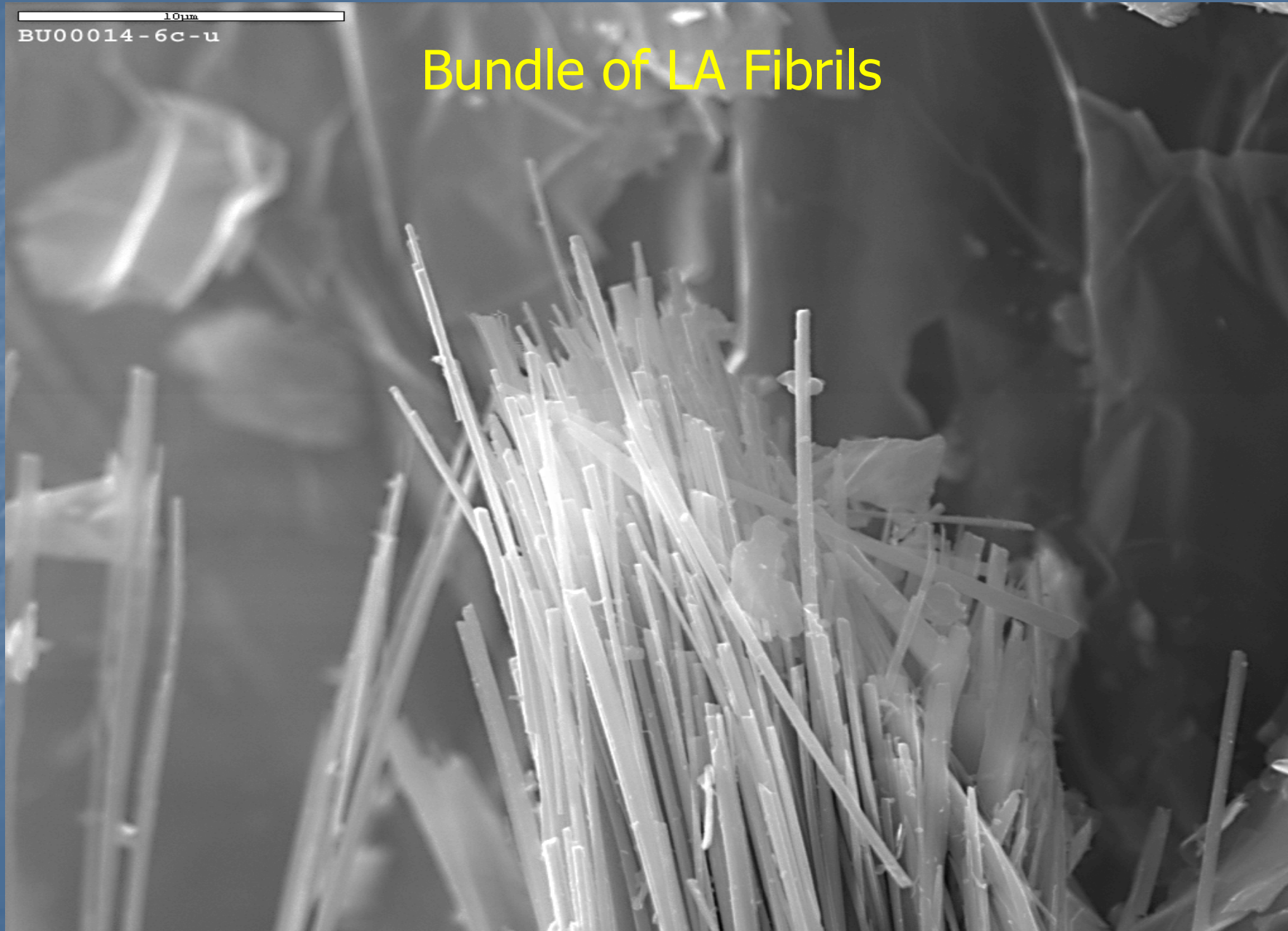
■ Amphibole

- Amosite
 - Crocidolite
 - Anthophyllite
 - Actinolite
 - Tremolite
- Libby

Straight



Libby Amphibole (LA)



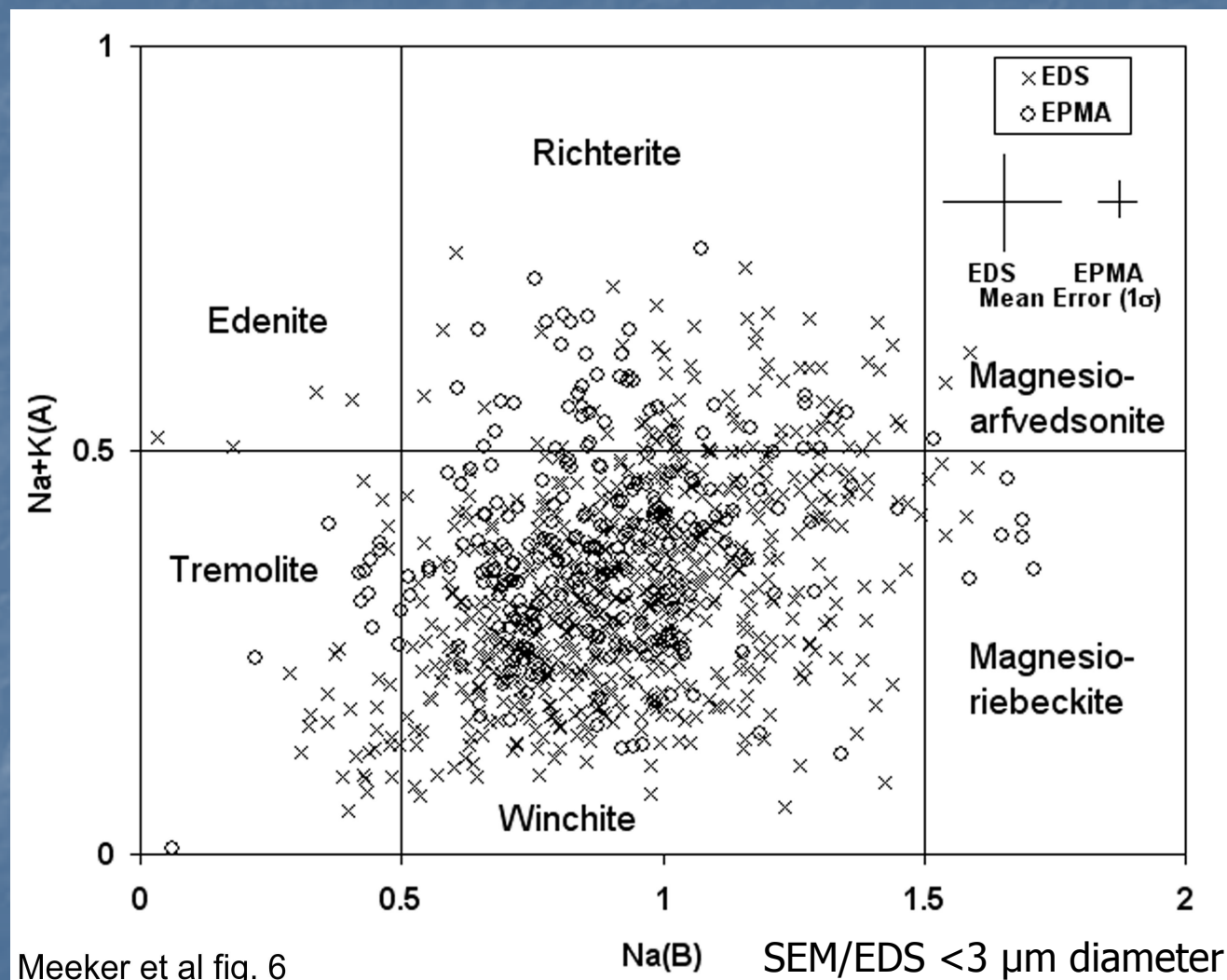
Libby Amphibole Composition

Based on the classification criteria of Leake et al. (1997).

Winchite 85%
Richterite 10%
Tremolite 5%



Classification Varies
Mineralogists
versus
Regulatory/Commercial



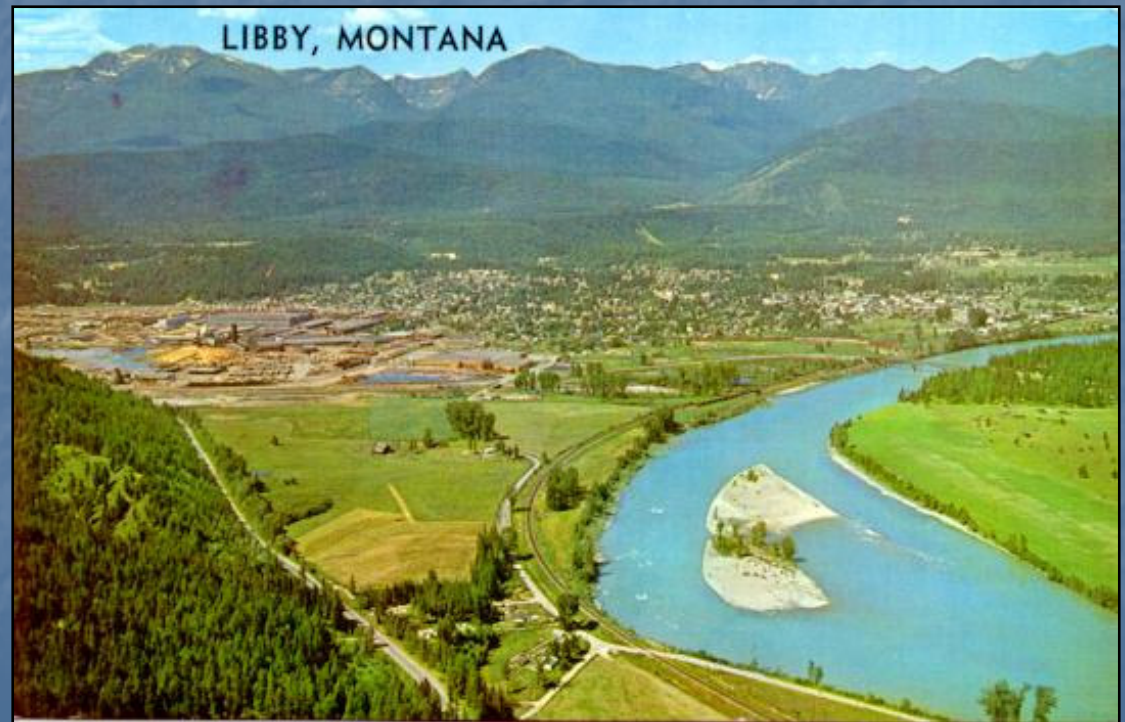
Meeker et al. (2003). The composition and morphology of amphiboles from the Rainy Creek complex, near Libby, Montana. American Mineralogist.

Asbestos Health Effects

- **Non-Cancer Fibrosis/Scarring** (latency >10 yrs)
 - Asbestosis – scarring of the air sacs
 - Pleural Fibrosis – scarring of lining around the lung
- **Cancer** (latency 20-40 yrs)
 - Lung Cancer
 - Increased risk of all lung cancer types, especially with smoking
 - Mesothelioma
 - Rapidly fatal cancer of the lining around the lungs & abdomen
 - Virtually all cases associated with asbestos exposure
 - Not affected by smoking
 - Other Cancers
 - Gastrointestinal & laryngeal

Libby, Montana

- Located in northwest Montana
- Area population: 10,000 (City 2,500)
- Area homes: 2,000 (400 City Homes)



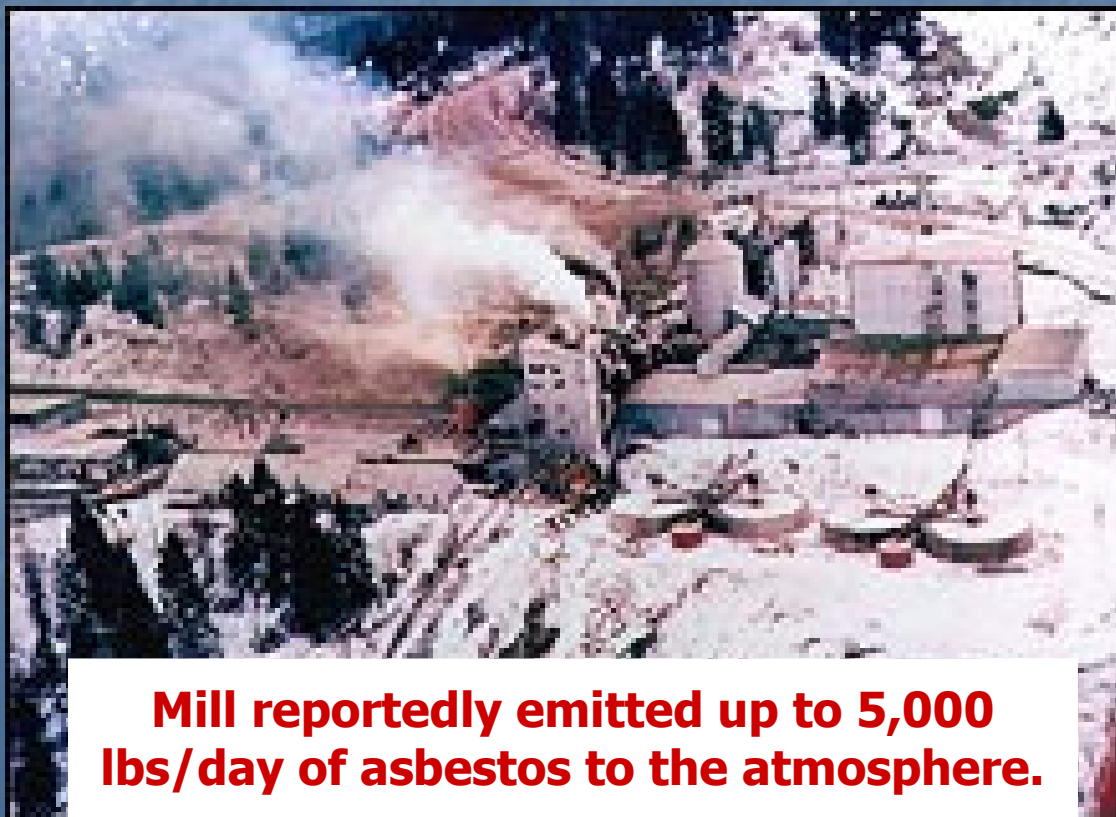


Zonolite Mine

- Vermiculite mine operated 1920 -1990
- Produced up to 80% of world's vermiculite
- WR Grace bought in 1963 & closed in 1991 (>> 5 million tons)
- Typically 150-200 working at mine & facilities
 - (>1800 workers employed in total)

WORKER ASBESTOS EXPOSURES

Earlier up to 130 f/cc
depending on job;
reduced later
(OSHA PEL 0.1 f/cc)



Mill reportedly emitted up to 5,000 lbs/day of asbestos to the atmosphere.

Libby Vermiculite Mine

Mine

Tailings Pile



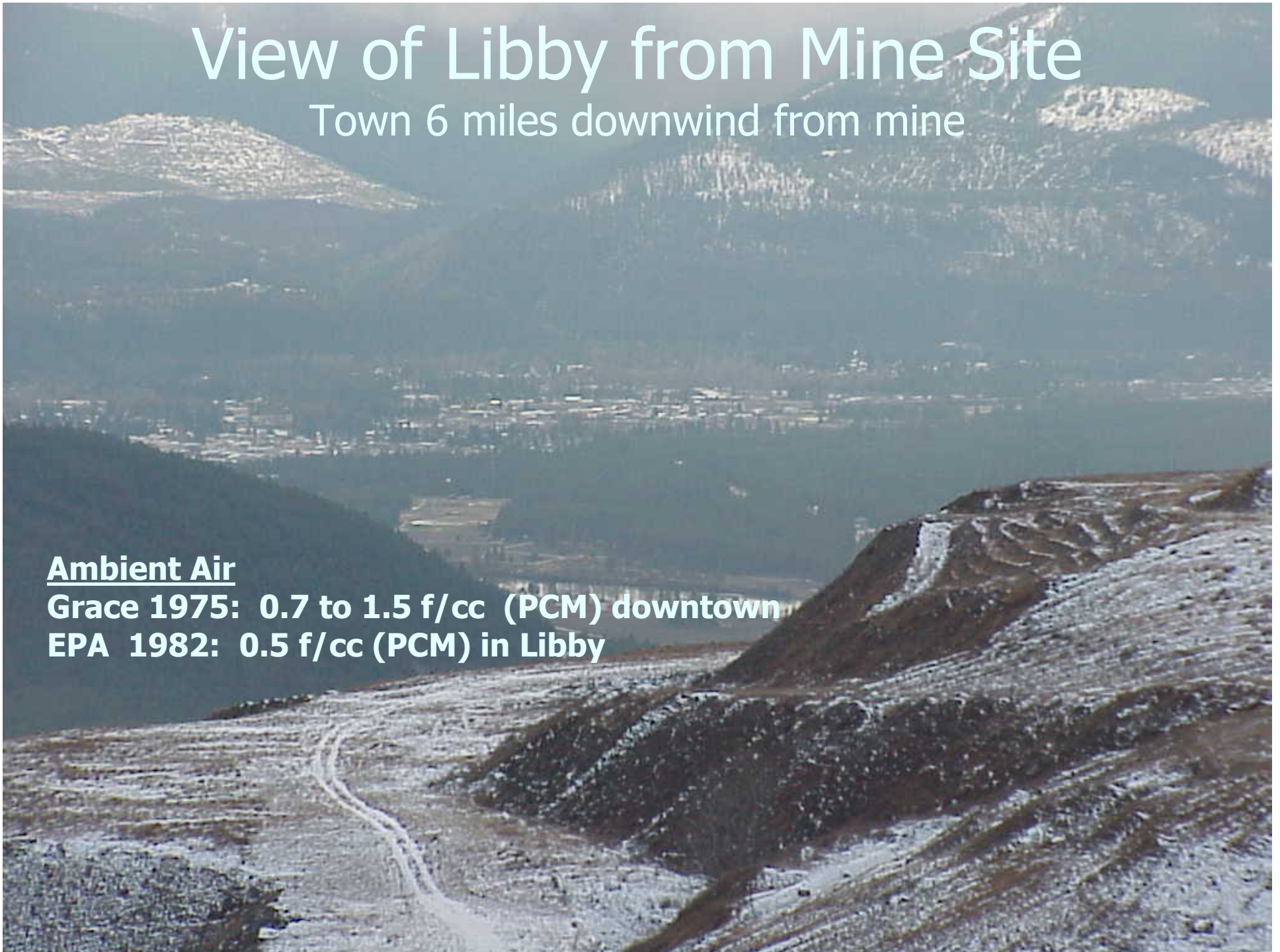
View of Libby from Mine Site

Town 6 miles downwind from mine

Ambient Air

Grace 1975: 0.7 to 1.5 f/cc (PCM) downtown

EPA 1982: 0.5 f/cc (PCM) in Libby



1928 USGS report described the mine as an amphibole deposit contaminated by biotite (vermiculite).

Vermiculite Ore



Libby Amphibole (LA)



Vermiculite Mining

Zonolite Mine

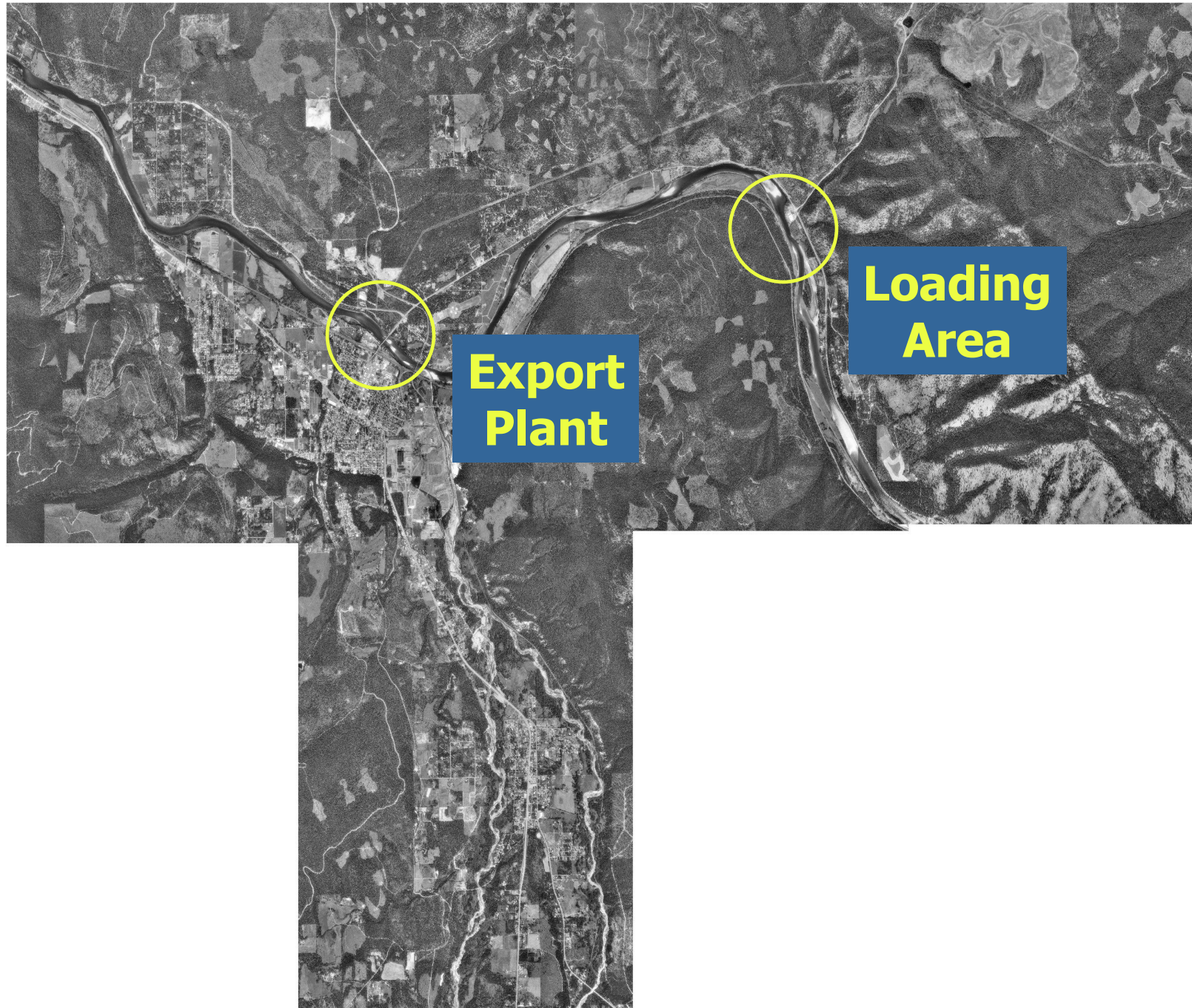
- Raw ore surface mined (up to 100% LA)
- LA in all vermiculite ore mined

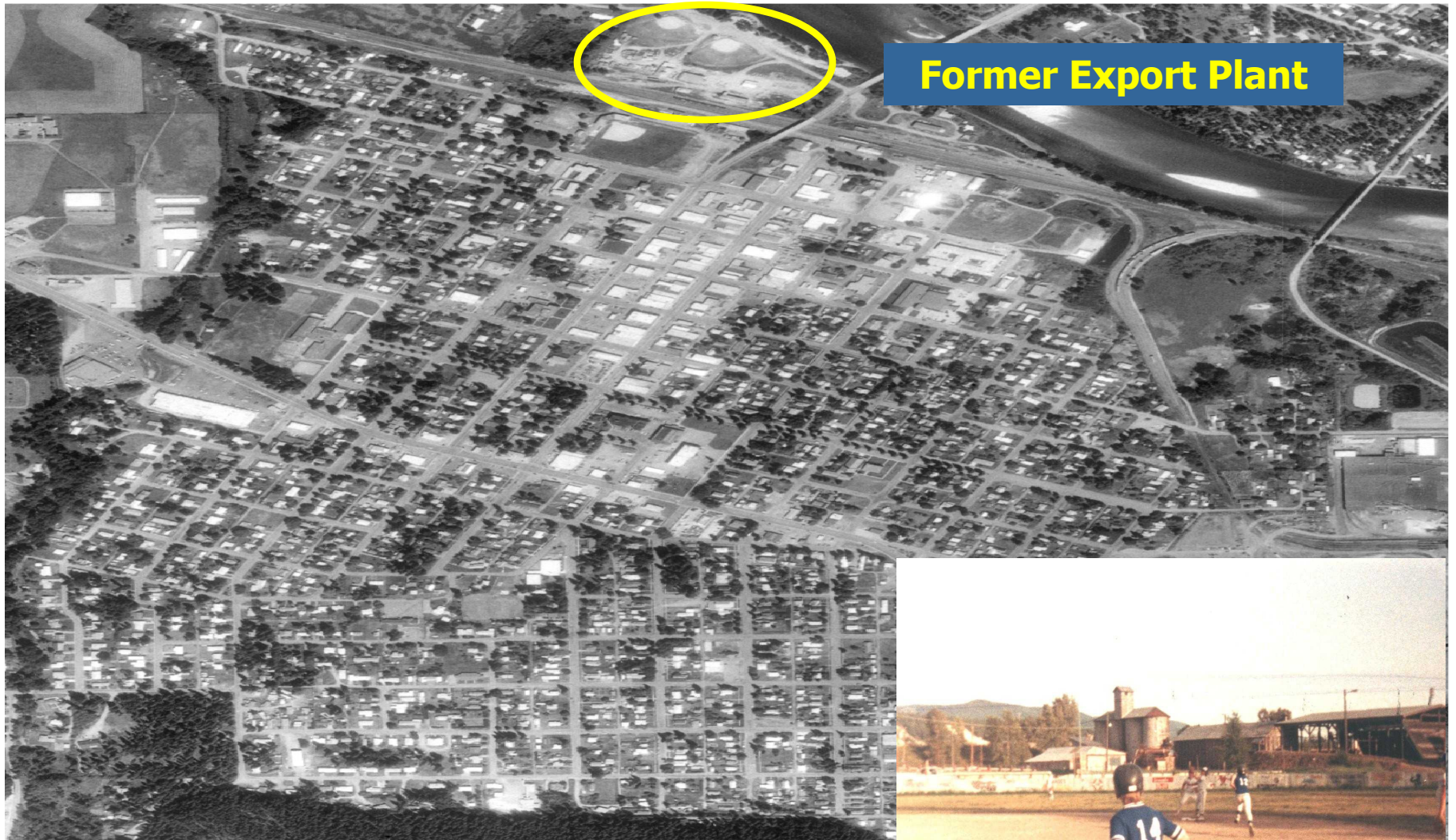
Vermiculite



Raw Asbestos Ore





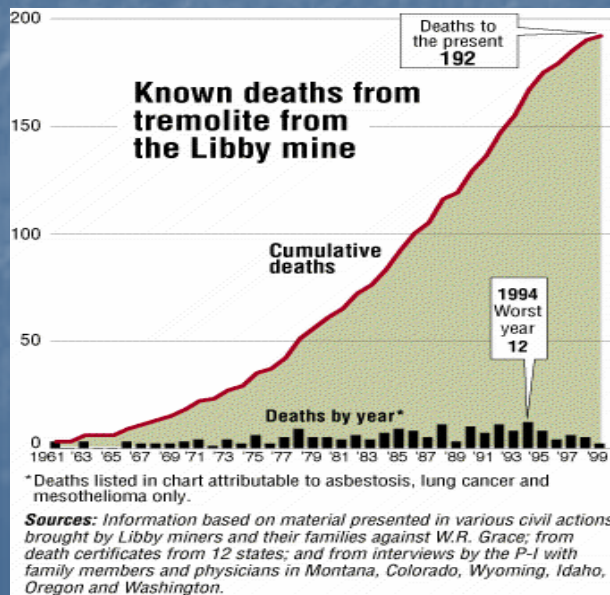




By **ANDREW SCHNEIDER**
SEATTLE POST-INTELLIGENCER SENIOR NATIONAL
CORRESPONDENT

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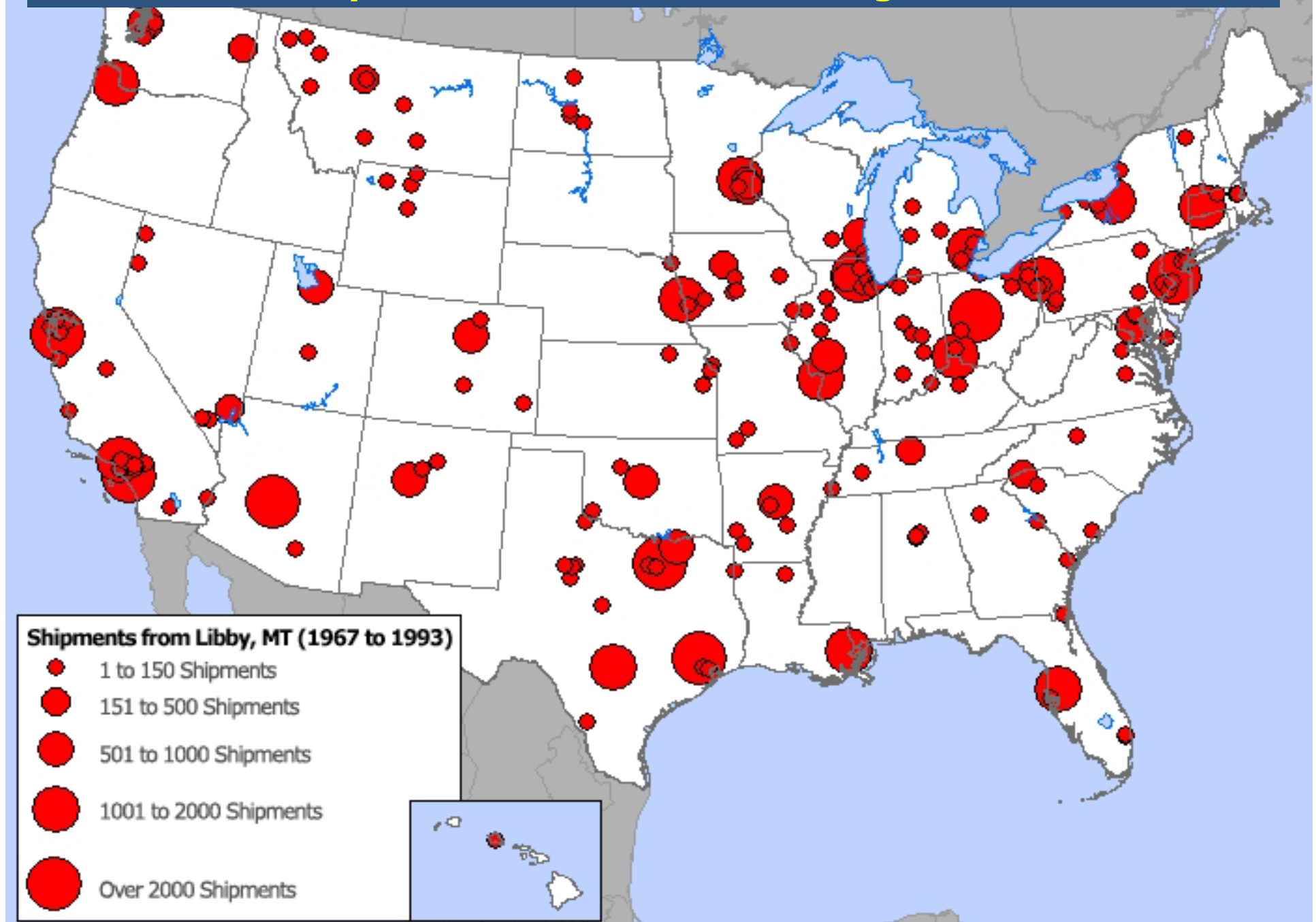
Uncivil Action: A town left to die



Tiny Libby, Mont., depended for years on the jobs at a vermiculite mine. But the mine is closed now, and a P-I investigation shows the town is paying a tragic price for those jobs. Hundreds of former miners, their wives and children, and other townspeople have either died or been diagnosed with fatal illness from asbestos the mine released into the air. No one stepped in to stop the dying. Now the town wonders when it will end, and if the town's children are still at risk.

"I want the people of Libby to know that we take very seriously these threats to their health and we are going to bring to bear the resources of EPA to solve the problem and prevent further harm," Yellowtail said.

Ore Transported to over 300 Processing Plants Nationwide



Historical Libby-related Health Data

Occupational

■ Libby Site

- Amandus (NIOSH; 1987) & McDonald Studies (1986)
 - Mortality: Increased risk asbestosis & lung cancer
 - Morbidity: Increased interstitial & pleural disease (x-rays)
 - McDonald Update (2003): Risk of mesothelioma (4.2%) in Libby miners, 10x that of chrysotile miners in Quebec; similar to crocidolite miners.
- Grace Records: 1980: X-rays: 5+ yrs >35%; 10+ yrs >45%; 20+ yrs >60%

■ Other Sites Processing Libby Vermiculite

- Lockey et al. (1984): OM Scott, Ohio: CXR abnormalities in 5% (n=513) of workers, pleural effusions, symptoms
 - Lockey Follow-up (2005): 26% Pleural abnormalities in same cohort
- Wright et al. (2002): Case-report - 65 year-old dies of progressive asbestosis; only reported exposures 2 summers at ages 18 & 19 in California processing facility

Libby Sisters

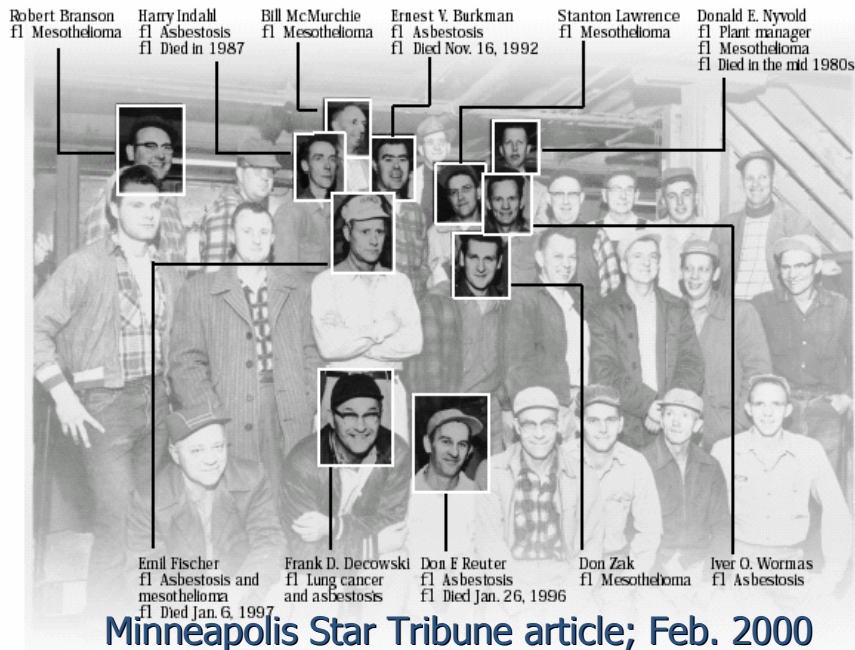
>300 US Vermiculite Processors

Minneapolis major clean-up

- > 1600 properties evaluated
- > 250 properties remediated

A hard-hit plant

This 1964 photo of workers in WR Grace Co.'s former Northeast Minneapolis plant was introduced in a court case by Hastings lawyer Michael Polk. Polk and surviving family members say that asbestos-related illnesses killed or contributed substantially to the deaths of at least 11 of the 28 employees photographed.



Source : Hastings law firm Sieben, Polk, LaVerdiere, Jones & Hawn; Star Tribune research Star Tribune graphic by Ray Grumney



- Srebro SH, Roggli VL (1994). Asbestos-related disease associated with exposure to asbestiform tremolite. Am J Ind Med.

Slide 20

E1

Justin and Tim Jorgensen, playing in the waste rock piles outside of the B.F. Nelson exfoliating plant in Minneapolis. Their father, Harris, died of mesothelioma on June 22, 1991 at age 44. His only known source of asbestos exposure was playing in these waste rock piles at the Nelson plant as a child.

EPA, 3/25/2004

Medical Investigations

- Funded by EPA, led by PHS and ATSDR
- Three pronged effort
 - Mortality Studies
 - Case-Series
 - Medical Screening

Libby Health Data Since 1999

Mortality Studies

■ **NIOSH**:*

- County asbestosis rate ~ 40X US rate;
- Age-adjusted rate 1988-1997 was highest in the US

■ **ATSDR**: (20 year study period: 1979 – 1998)

- Increased risk compared to MT & US populations
 - Asbestosis: 40-80x higher
 - Lung Cancer: 20-30% higher
 - Mesothelioma: marked increase (rate not quantifiable)
 - Observed 3/~ 2500 (deaths outside county not counted)
 - Expected: typically estimated <10/million
 - >30 cases reported among current and former Libby residents

* Evaluation NCHS data per R. Castellan, MD; NIOSH/DRDS

Libby Medical Screening

Funded by EPA, led by ATSDR & PHS

- >7300 individuals screened
- World's largest single point asbestos screening
- Basic screening consisted of
 - Three view chest x-rays
 - Basic spirometry
 - Extensive exposure questionnaire



Prevalence of Pleural Abnormalities

Asbestos-Related X-Ray Changes

■ **Libby Site: 18% Overall**

- 5% with no apparent exposure
- 57% among former workers
- 24% among participants with 6+ reported pathways
- >75% of those with abnormalities are non-workers, non-family members

■ **Other US Studies:**

- 0.2%: 1422 blue-collar workers in North Carolina (Castellan 1985)
- 0.9%: 693 loggers in Washington and Oregon (Stibolt 1991)
- 1.8%: 326 New Jersey residents (Anderson 1979)
- 2.3%: 1212 patients at VA hospitals in NJ (Miller 1996)
- 3.9%: cross-sectional 1060 US adults, workers included (Rogan 2002)

Asbestos Pleural Disease

Implications

- Increased Risk of Malignancy
 - lung cancer, mesothelioma!
- Functional Impairment & Increased Symptoms
 - Both circumscribed & diffuse disease
- Progression
 - Treating physician of Libby patients
 - 94/123 (76%) patients followed over time had significant decline in pulmonary function (Whitehouse, 2004)
 - Marysville Update 2005
 - Increase in observed x-ray abnormalities over 20 year period (from 5% to 25%)
 - Other studies show a 14%-30% increase in x-ray abnormalities 20+ years after exposure
 - 37% of amosite workers with < 1 month exposure had progression of interstitial & pleural disease 20 years after end of exposure (Erlach 1992)

Libby Non-Occupational Exposures

Historical & Present

- Family Contact With Workers
- Ambient Air
- Other
 - Playing in vermiculite piles
 - School areas (e.g., running tracks)
 - Home insulation
 - Garden use
 - Driveways
 - Popping on stove



Recent Exposures in Libby

- **Two Former Processing Areas** (areas in public use)
 - Contained LA up to 35% by PLM
 - Scenario testing indicated significant exposure & risk
- **Mine**
 - Entirety covered with LA up to 100%
- **Mine Road**
 - LA contamination generates elevated airborne levels with traffic
- **Schools/Parks**
 - Mine tailings used at school tracks and city parks
- **Commercial/Residential Properties**
 - >40% have LA in yard, indoor dust or Vermiculite Attic Insulation (VAI)
- **Troy?**

Site Approach To Date

- Use Removal Authority to do “Worst First” Cleanups
- Parallel Track the Development of a ROD Using Removal Data to Support an RI/FS and Baseline Risk Assessment (BRA)
- Maximize Number of Properties Cleaned Up per Year, While Minimizing Cost per Property

Worst First

- Former Processing Areas and Schools
- Areas Where Bulk Disposal Took Place
- Multiple Sources With High Levels
 - (e.g. yard $>1\%$ and $>5,000$ s/cm² and Zonolite present)
- Single Source With High Levels
 - (e.g. yard $>1\%$, dust $>10,000$ s/cm²)
- “Leaking” or “Disturbed” Zonolite Insulation

Current Removal Triggers

- Presence of VAI in Attic (not walls)
- Dust $> 5000 \text{ s/cm}^2$ in Living Areas
- LA $> 0.2\%$ in Specific Use Area
 - Gardens, Flower Beds, Play Areas
- LA $> 1.0\%$ in non-Specific Use Area
 - Yards, Fields

Cleanup Description

- Former Processing or Disposal Areas
 - Classic “Dig and Hauls”
 - Zonolite Mine Being Used for Disposal
 - Contaminated Equipment, Buildings, and/or Debris Either Cleaned or Disposed of As Needed
 - >350,000 yds³ of Contaminated Soil Removed

Excavation at Screening Plant





Disposal Area





Cleanup Description

- Residential/Commercial District
 - Bulk Soil/Source Removal First
 - Vermiculite Insulation Removal Second
 - Interior Cleaning Last
 - Clearance Using AHERA “Like” Protocol





Typical Interior Removal Methods

- Remove VAI via Remote Vacuum System
 - Attic, Not Wall Space
- HEPA Vacuum Attic
- Seal Wall Space
- HEPA Vacuum/ Wet-Wipe Living Space
- Clear Property Via Aggressive Air Sampling
 - TEM Analysis

Vermiculite Attic Insulation (VAI)



Insulation made from Libby ore





Current Situation - Cleanups

- Large Source Areas Effectively Done
- Approximately 1400 Properties in Libby Commercial/Residential Area Need Cleanup
 - How Many in Troy?
- At End of 2006, A Total of 753 Properties Will Be Completed
- Typical Residential Property Costs ~\$45k Directly, ~\$70k With Overhead

Current Issues - Cleanups

- Number of Properties Completed to Date Less Than Projected in 2003 (753 vs. 1169)
- More Properties in Libby Need Cleanup Than Identified in 2003 (1420 vs. 1231)
- Per Property Cleanup Costs Are Rising (~30%)
- Property Cleanups Becoming More Complex

Current Issues - Technical

- Limited Understanding of Long-Term Efficacy of Current Removals (Only Available for 4 of 753 Homes)
- Removal Data Insufficient to Support BRA (See Conceptual Site Model)
 - Insufficient quality & quantity, not representative
- Progress Frustrated by Sampling & Analytical Methods
- Current IRIS Risk Model Insufficient for Site
- RI Has Not Started on Mine or Troy

Current Issues - Technical Sampling & Analysis

- Analytical sensitivity for air samples may not reach level of concern (e.g. current ambient air data)
- Bulk (PLM) Methods poor sensitivity (~ 0.2 by weight %)
- **Solid media** measurements (soil, ore, insulation, dust) cannot be converted to estimations of exposure & risk
 - Disturbance of contaminated media $\ll 1\%$ asbestos still generated high airborne exposures
 - **ND soils can generate high airborne exposures!**

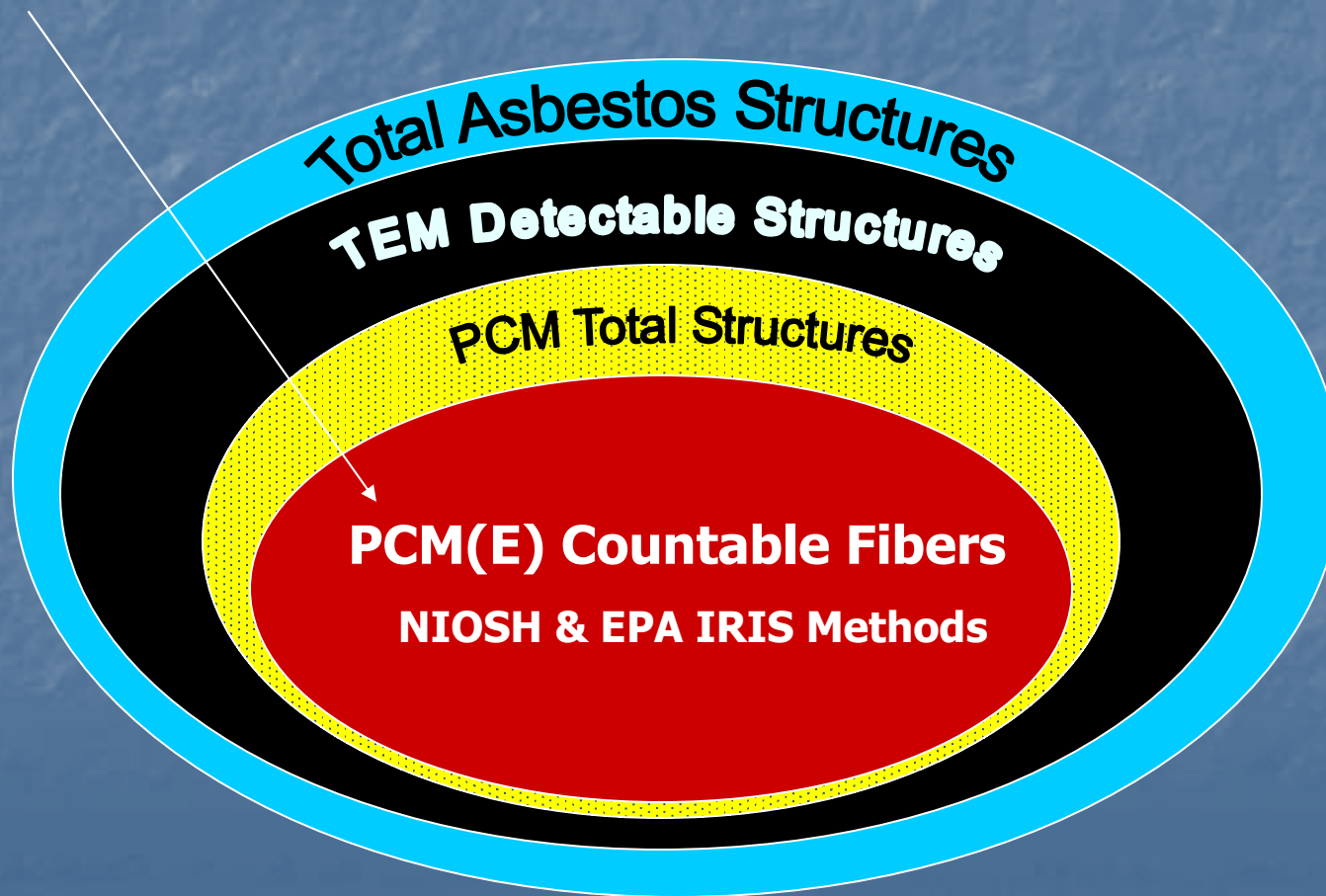


Current Issue-EPA IRIS Risk Model Weaknesses

EPA Risk Assumption:	What the Science Says:
<i>All fibers are chemically identical in terms of toxicity.</i>	Amphiboles appear to be more potent with respect to mesothelioma (likely lung cancer & lung fibrosis).
<i>Shape/Morphology does not influence fiber toxicity.</i>	<i>In vivo</i> and <i>in vitro</i> toxicity studies demonstrate strong influence of fiber width and length on toxicity.
<i>PCM fibers adequate surrogate of exposure to use for risk assessment.</i>	Fibers not counted by PCM are toxic (i.e. shorter and thinner fibers likely contribute to risk).
<i>Non-cancer risks from fiber exposure are not significant for residential exposures.</i>	Non-cancer bio-changes affect >18% of Libby population. Non-cancer risks may be new driver.

Asbestos Fiber Detection & Counting TEM versus PCM

- **IRIS Definition: Phase Contrast Microscopy (PCM)**
 - Length ($>5\text{ }\mu\text{m}$), Width ($>0.25\text{ }\mu\text{m}$), Aspect Ratio (Length:Width Ratio $> 3:1$)



More Current Issues

- Congressional Pressure
- Community Unease
- OIG Investigation (See Letter)
 - Use of Science
 - Community Input
 - ROD(s)

Proposed Approach

- Reorganize Site Attack
 - Mine
 - Former Processing Areas
 - Libby Commercial/Residential District
 - Troy
- Invest in Fundamental RI and Initiate Scientific Investigations in FY 2007
 - Critical to ROD Development
- Prepare Separate RODs for Areas Where Exposure Pathways Are Broken
 - e.g. Processing Areas

Proposed Approach

- Update RA Fund Request to Priority Panel to Reflect Current Situation
- Adjust Current Cleanup Strategy
- Increase Regional Pipeline Commitment to Facilitate Technical Projects
- Request Additional Pipeline Funding From HQ to Supplement Regional Budget

Enforcement Update